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N63-86146 Code 5 (NASA CR 52668)

Director
George C. Marshall Space Flight Center
Huntsville, Alabama

Attention: M-P&C-CA

Subject: NASA Contract NAS 8-5188
"Capability Development of Adhesive Bonded Studs" Progress...
Progress Report No. 7
Covering Period 1 July 1963 to 1 August 1963

Gentlemen:

This monthly progress report briefly describes the work conducted under subject contract during the period 1 July 1963 to 1 August 1963.

Forty stud specimens, bonded to etched 5456 bare aluminum plate, were tensile shock tested. Four groups of 10 studs were bonded with each of the four adhesive systems being investigated.

TENSILE SHOCK TESTS

All tensile shock tests were conducted using an Avco-type SM 005-1 shock tester with a Tektronic-type 543 oscilloscope and a camera, coupled with an Endevco-type 2215 accelerometer. This setup produced a shock pattern on the oscilloscope that was photographed by the camera. For reasons of economy, all shocks on all specimens were not recorded by the camera. The shock machine was calibrated prior to the test run, and driving air pressure was coordinated with the resultant shock. Spot checks were made throughout the test, and a final check was made when the test was completed to assure nonvariation of the calibration. The test fixture was attached to the shock machine in such a manner that the specimen plate was suspended with the stud pointing downward. In order to place the stud in tension during the deceleration shock, a 10-pound weight was screwed onto the stud. (Results of the test are shown in Tables I through IV.)

Results of the tests on 7133/7130 adhesive with 0.002" thick Estane flexible film (Table I) were somewhat erratic, with only one cohesive failure at 200 G's. The

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TABLE I

TENSILE SHOCK TESTS

7133/7130 Adhesive With 0.002 Estane Flex Film

Specimen No.	Load In G's	No. of Shocks	Remarks
1	130	5	
	146	1	
2	130	5	All failures adhesive except No. 9 which was cohesive
	146	1	
3	200	1	
4	146	1	
5	138	5	
	146	1	
6	138	1	
7	138	1	
8	138	1	
9	138	5	
	146	5	
	185	5	
	200	5	
10	138	5	
	146	5	

TABLE II

TENSILE SHOCK TESTS

7133/3170 Adhesive With 0.005 Estane Flex Film

Specimen No.	Load In G's	No. of Shocks	Remarks
1	75	5	All failures cohesive
	110	5	
	120	5	
	130	5	
	146	5	
	185	5	
	200	5	
2	185	5	
	200	3	
3	200	4	
4	200	5	
	216	4	
5	200	5	
	216	2	
6	200	2	
7	200	5	
	216	1	
8	200	1	
9	200	4	
10	200	5	
	216	3	

TABLE III

TENSILE SHOCK TEST

X-305 Adhesive With 0.002 Estane Flex Film

Specimen No.	Load In G's	No. of Shocks	Remarks
1	130	1	All failures adhesive
2	130	2	
3	130	1	
4	100 110 120 130 146 180 200 216 230 250 260	5 5 5 5 5 5 5 5 5 5 2	Specimen No. 4 was subjected to a total of 52 shocks of increasing intensity and failed on the second 260 G shock
5	130	2	
6	100	1	
7	100	1	
8	100	1	
9	100	1	

TABLE IV

TENSILE SHOCK TEST

X-305 Adhesive With 0.005 Estane Flex Film

Specimen No.	Load In G's	No. of Shocks	Remarks
1	130	2	All failures adhesive
2	130	2	
3	130	4	
4	130	2	
5	130	5	
	146	5	
	185	1	
6	130	1	
7	130	1	
8	130	1	
9	130	1	
10	130	1	Specimen No. 10 was subjected to a total of 29 shocks of increasing intensity. Failure occurred on the third 250 G shock
	146	5	
	185	5	
	200	5	
	216	5	
	230	5	
	250	3	

7133/7130 adhesive with 0.005" Estane film was much more consistent, with all failures cohesive at approximately 200 G's.

These tests gave strong indications that the cohesive strength of the 7133/3170 adhesive is the limiting factor, and that 200 G's acceleration (when the stud is supporting a 10-pound weight) is all that can be expected.

Test results for the X-305 adhesive with 0.002" Estane film were even more erratic. However, all failures were adhesive, and sustained shock loads were as high as 260 G's on one exceptional specimen.

Test results for the X-305 adhesive with 0.005" Estane film were also erratic. There is little reason to assume that one film thickness is better than the other in these tests.

It should be noted that the loading on the X-305 adhesive specimens did not reach the cohesive strength of the adhesive, and that all failures must be considered premature. Investigation after the tests revealed that the baths used for etching the specimens were not functioning at full efficiency (which may account for all failures being adhesive).

Erratic tensile shock tests were expected, since this type of test on block tensile specimens (as conducted under Contract NAS 8-1565) and a brief literature survey indicated that results are usually so widespread that they are considered meaningless.

The narrow spread of shock shear results of X-305 (see Monthly Progress Report No. 6) can be explained by the fact that the strength of the adhesive system exceeded that of the stud.

A minimum number of additional stud specimens will be tested in tensile shock in an attempt to determine the reason for the widespread results.

Forty specimens have been fabricated for a vibration test, which will consist of a low G level resonant search of 10 minutes duration followed by a dwell of five minutes at the most severe resonant frequency. The G level will be increased to specimen failure, or to the machine's maximum capability, during this dwell. This method should establish the maximum G load that can be supported at the most severe resonant frequency. This vibration test will be completed during August 1963, at which time all testing results will be compiled. Permission to proceed with Phase III of this program will then be requested.

The work completion schedule is shown in Figure 1.

Very truly yours,

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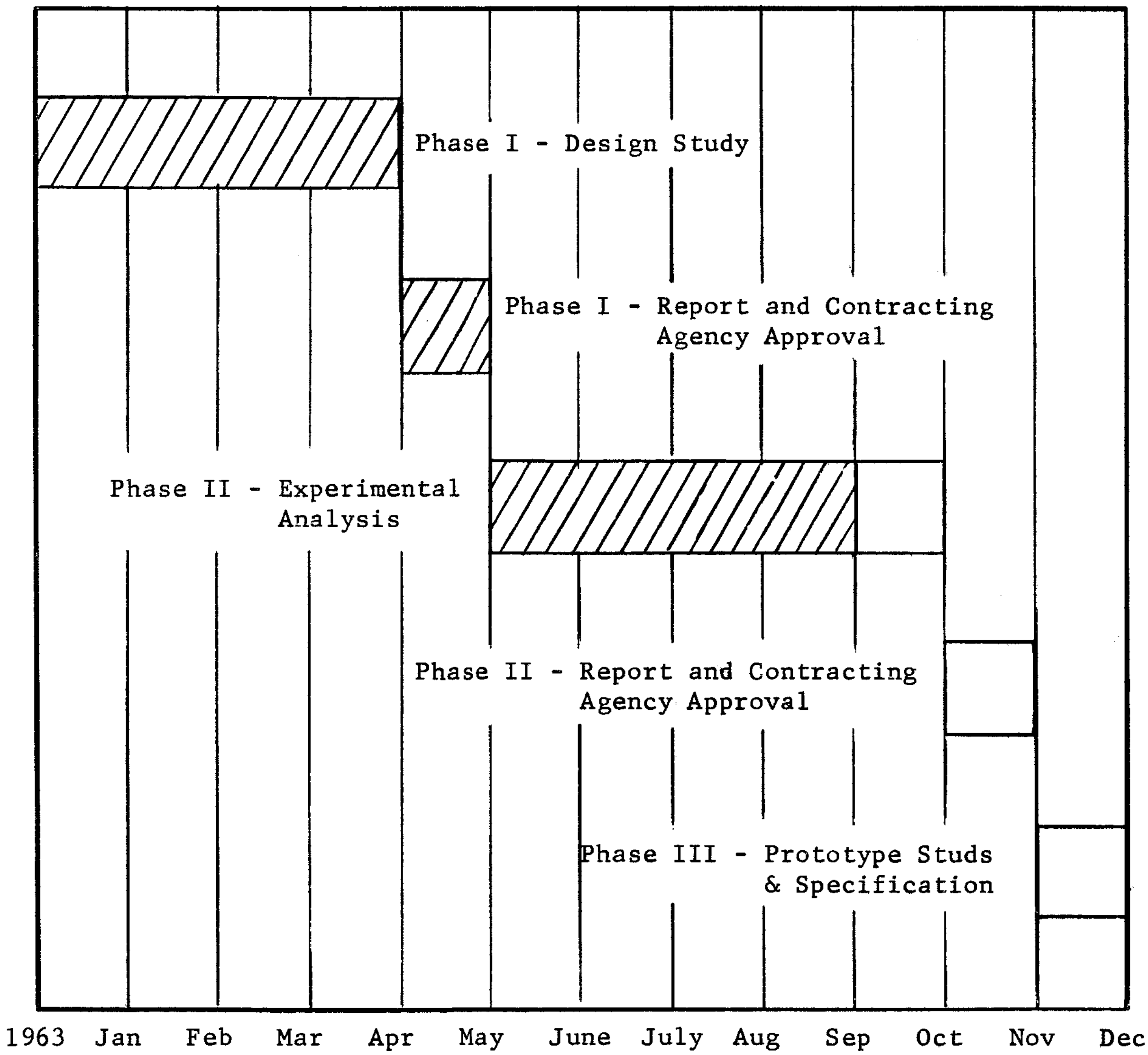

Figure 1. Schedule of Work